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N. N. Nelson, P. O'Shell, S. Hendrickson, V. Sukhoruchkin, S. Antipov, E. Melkhov, N. Ponomarev-Steponi, N. Yurasov

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COOPERATIVE MPC&A ENHANCEMENTS AT RUSSIAN NAVY SITES

United States Contributors:
N. Nicole Nelson
U. S. Department of Energy National Nuclear Security Administration
Office of International Material Protection and Emergency Cooperation
Parker O' Shell
Oak Ridge National Laboratory
Sheilah Hendrickson
Lawrence Livermore National Laboratory

Russian Federation Contributors:
V. Sukhoruchkin, S. Antipov, E. Melkhov, N. Ponomarev-Stepnoi
Russian Research Center, "Kurchatov Institute"
Admiral N. Yurasov
Russian Federation Navy

ABSTRACT
U.S. MPC&A cooperation with the Russian Federation (RF) Navy is based on a Joint Statement signed in 1996 to protect Highly Enriched Uranium (HEU) fresh fuel used for nuclear propulsion. The Russian Federation Navy is the largest owner in Russia of highly enriched uranium, both in the form of fresh nuclear fuel, and in the form of slightly irradiated fuel with a long cooling time after irradiation. As a result of this agreement, projects began at the Northern Fleet Fresh Fuel Storage Facility (Site 49) and Refueling Ship PM-63. Initial projects provided upgrades for RF Navy HEU fresh fuel storage facilities, beginning with a land-based facility near Murmansk and later adding other land-based and ship-based fresh fuel storage facilities. Additional protocols (December 1997, January 1999, and March 2000) significantly expanded cooperation to include all HEU fuel under RF Navy control. To date, it is estimated that tens of metric tons of HEU have been secured – enough to construct hundreds of nuclear devices. It was determined that the cooperation would be coordinated by the Russian Research Center, Kurchatov Institute. This paper describes the history of the Program development, its stages, current status, scale of the work and prospects.

THE BEGINNING
The Department of Energy (DOE) National Nuclear Security Administration (NNSA) Material Protection, Control, and Accounting (MPC&A) Program began initial cooperation with the Russian Federation (RF) Navy in 1996 based on a Joint Statement to protect Highly Enriched Uranium (HEU) fresh fuel used for nuclear propulsion. Initial projects provided upgrades for RF Navy HEU fresh fuel storage facilities, beginning with a land-based facility near Murmansk and later adding other land-based and ship-based fresh fuel storage facilities. Additional DOE and RF Navy protocols, dated December 12, 1997, January 21, 1999, June 11, 1999, and March 1, 2000, significantly expanded cooperation to include *all* (fresh and spent) HEU fuel under RF Navy control and sites that store nuclear warheads (sensitive sites) in the North and Far East. To date, it is estimated that over 50

metric tons of HEU have been secured through the mutual cooperation of the DOE NNSA and RF Navy – enough to construct hundreds of nuclear devices.

Kurchatov Institute serves as the contracting intermediary organization for the RF Navy and DOE NNSA National Laboratories and plays a key role in the implementation of the MPC&A upgrades at RF Navy sites. The Kurchatov Institute (KI) has been cooperating with the RF Navy for over 50 years. Nearly all of the designs for RF naval nuclear reactors and their fuels were developed by KI. In addition KI has developed RF naval nuclear reactor courses for the RF Navy and the Institute has trained hundreds of RF Navy officers. The most recent training developed by KI for the RF Navy is the fundamental and advanced MPC&A courses for operators and managers responsible for MPC&A operations of RF Navy fresh fuel in storage and transportation.

THE PROTOCOLS

The December 1997 protocol reflected both sides' satisfaction with the cooperative program, and expanded the scope significantly to include *all* fresh HEU fuel under RF Navy control. This protocol provided for consolidation of the fuel into two land-based storage sites, one for the Northern Fleet and one for the Pacific Fleet. As a result, projects for consolidation of fuel began at Northern Fleet Fresh Fuel Storage Facility (Site 49) and Refueling Ships PM-63 and PM-12, and Pacific Fleet Fresh Fuel Storage Facility (Site 34) and Refueling Ship PM-74. The protocol also included a program for MPC&A upgrades at Sevmash Shipyard, a facility under the Ministry of Economics, where fresh fuel is stored, and provided for the possibility of further expansion of joint cooperation to include spent RF naval nuclear fuel and integrated disposal.

The January 1999 protocol further expanded the scope of cooperation. This protocol included the Pacific Fleet Spent Fuel Storage Facility (Site 32); spent fuel compartments for refueling ships PM-74 of the Northern Fleet, and PM-12 and PM-63 of the Pacific Fleet; and Sergiev Posad (RF Navy research facility utilizing fresh HEU) under the control of the 12th Main Directorate, another service arm of the Ministry of Defense. The protocol also included an initial project for protection of sensitive sites, a RF Navy Regulation Project for the development of regulations for accounting HEU, and a RF Navy Training Project for development of training courses for RF Navy personnel on operating upgraded MPC&A equipment. In addition, the protocol called for MPC&A systems for RF Navy nuclear submarine docking areas and facilities that both refuel and decommission RF Navy nuclear submarines. It also called for DOE NNSA to consider the feasibility of a RF Navy proposal to equip Pacific Fleet Shipyard 49K in Kamchatka for the purpose of unloading spent nuclear fuel and dismantlement of nuclear submarines. The RF Navy has repeatedly stressed the concept of "same faces" and included a statement in the protocol that limits participation to current team members and requires that any new personnel must have approval from both sides.

The June 1999 protocol agreed to proceed with a full feasibility study for RF Navy Shipyard 49K and further allowed for mutually agreed upon personnel additions to accommodate the work. In addition, this protocol expanded the number of sensitive sites

by initiating projects to cover *all* such facilities in the Northern and Pacific Fleets during the next two years.

The March 2000 protocol provided another expansion of cooperation with the RF Navy. This protocol included another increase in the number of sensitive sites and covered *all* such facilities in both the Northern and Pacific Fleets.

THE AGREEMENT

On August 31, 2000, Secretary Richardson signed an Implementing Agreement with the RF Ministry of Defense titled, *"Agreement Between the Department of Energy of the United States of America and the Ministry of Defense of the Russian Federation Regarding Cooperation in the Area of Nuclear Materials Accounting, Control and Physical Protection,"* that outlines expanded future cooperation in the area of nuclear material security. Commander-in-Chief of the RF Navy, Admiral of the Fleet Vladimir Kuroyedov, signed on behalf of the RF. This agreement further codified the work that had been done in the past and set the stage for additional cooperation in the area of nuclear material protection. This agreement included provisions such as:

- Improving the conditions for secure and reliable storage and transport of nuclear materials,
- Control and physical protection of nuclear materials at Russian facilities and carrying out activities in accordance with previously signed protocols,
- Improving physical protection at RF Navy Northern and Pacific Fleets nuclear fuel storage facilities, ashore and afloat,
- Equipping a training center to train personnel in nuclear materials accounting, control and physical protection,
- Control and physical protection of nuclear materials at nuclear submarine bases as well as RF Navy enterprises,
- Conducting feasibility studies and other mutually agreed upon cooperative activities consistent with the objectives of this Agreement.

THE FUEL

The RF Navy uses highly enriched uranium (HEU) 20-90% fuel for nuclear-powered ships such as submarines. This nuclear material has been categorized as weapons-useable and as such, it is subject to the Material Protection, Control, and Accounting (MPC&A) Program's goal of reducing the risk of nuclear weapons proliferation by strengthening the security of such materials. Fuel rods are stored in land-based facilities and/or floating platforms until used to refuel ship reactors. This interim storage involves intra-site transportation, secure port facilities, service ships, and refueling facilities. The focus is on the physical protection and item accountancy of the fuel rods from the time they are delivered to the RF Navy until the time the RF Navy enters the fuel rods into refueling operations.

Recent calculations have shown that some *spent* naval fuel not only retains its HEU characteristics, but within approximately ten years from reactor shutdown becomes cool enough to become a proliferation risk. That is, it is no longer self-protecting under

International Atomic Energy Agency (IAEA) standards. The RF Navy strongly endorses this conclusion, even though security considerations prevent the disclosure of actual radiation levels over time.

THE PROJECTS

Sevmash Shipyard – In late 1998, a project at the Sevmash Shipyard in Severodvinsk began. Upgraded physical protection systems have been installed for the land-based facility, Building 438, for RF naval fresh fuel. In early 2001, a second facility, Building (Object) 458 was included to receive security upgrades. New and existing MPC&A system features are being integrated for detection, communications, delay, response, material control, and item accountancy systems. The anticipated commissioning ceremony for this site is May 2002.

Sergiev-Posad – This Naval research facility includes pulse reactors that operate on HEU fuel. Upgraded physical protection for the buildings containing the pulse reactors and fuel storage area is being provided. The MPC&A system upgrades incorporate detection, communications, delay, material control, and item accountancy. The anticipated commissioning ceremony for this site is August 2001.

Pacific Fleet Site 86 – This facility adjoins Site 32 as part of an integrated spent fuel complex. It is used for loading spent fuel assemblies into shipping casks and has an outdoor staging area where shipping casks reside until shipment. MPC&A upgrades will be compatible with MPC&A upgrades at Site 32 and adjoining Site 34 and will provide an integrated MPC&A system for nuclear material stored at this geographical location. The anticipated commissioning ceremony for this site is September 2001.

RF Navy Training and Regulations – These projects were initiated in 1998 to provide training courses for Navy operators and managers responsible for RF naval fresh fuel in storage and transportation. Technical assistance has been provided for the identification and adaptation of existing training curricula, facilities and materials or development of new training assets to assure MPC&A upgrades such as security equipment are operated and maintained as effectively as possible. MPC&A regulations for handling nuclear materials and security procedures for protecting nuclear materials have been written for the RF Navy by Kurchatov Institute. These projects are not site specific, but rather encompass all of the sites in the RF Navy involved in the MPC&A Program.

Kola Technical Center – In November 2000, the RF Navy requested that several technical centers be established in remote locations in Russia to support the MPC&A equipment installed at upgraded RF Navy facilities. To date, several facilities have completed security system upgrades and many more will be completed in the near future. In response to the RF Navy request to promote sustainability of these systems, a strategy is being developed to ensure the long-term, efficient operation of upgraded sites by utilizing technical support centers. The primary goal of these centers will be to make available a sound MPC&A support within the RF so that the RF Navy can become self-sufficient in sustaining all system component upgrades and human resource applications after the DOE NNSA MPC&A Program support ends.

As part of this strategy the MPC&A Program is currently cooperating with the RF Navy to establish a pilot technical support center in the Kola region. Primarily, the center will provide appropriate technical support elements including training, maintenance activities, budget planning and procedures for the center activities to sustain the MPC&A elements at upgraded RF Navy sites in the Kola region.

THE PROJECTS IN SUSTAINABILITY PHASE

Northern Fleet Refueling Ship PM-63 – This ship is located in the Northern Region of Russia and is based in Severodvinsk near Arkhangelsk. The ship's storage compartments have capacity for a large number of fresh fuel rod assemblies, spent fuel rod assemblies and a large volume of liquid radioactive waste. A commissioning ceremony was held in September 1999, for the MPC&A ship-based and land-based (at specific shore locations where the ships may be docked) system upgrades and upgrades to response force capabilities.

Naval Fresh Fuel Storage Facility (Site 49) – This is the Northern Fleet consolidated land-based storage site for fresh fuel in possession of the Northern Fleet. All fuel is securely stored in one location in the Murmansk region. A commissioning ceremony was held in September 1999, for the MPC&A upgrades to the site and the new hardened storage building constructed to double the initial storage capacity.

Murmansk Shipping Company (Icebreaker Fleet), Atomflot Port – Murmansk Shipping Company is the only commercial shipping facility (operated by the Ministry of Transportation) that has received MPC&A upgrades for the protection of fresh nuclear fuel used by the Icebreaker Fleet. A commissioning ceremony was held in September 1999, for the security systems for the Atomflot Port and the ship Imandra, which is used to refuel the Icebreaker Fleet.

Northern (PM-12) and Pacific (PM-74) Fleet Refueling Ships – These are sister ships to Northern Fleet Refueling Ship PM-63 based in Severodvinsk near Arkhangelsk. PM-12 is based near Murmansk and PM-74 in Vladivostok. The primary service provided by the PMs involves the refueling of nuclear powered ships, including submarines. Spent fuel is removed from the other ship's reactors and temporarily stored on board the PMs. Fresh fuel is transferred from the PMs to the other ship's reactor(s). Spent fuel is transferred from the PMs to interim storage, and the final step is rail shipment to Mayak. The PMs have large storage compartments for fresh fuel rod assemblies, spent fuel rod assemblies, and liquid radioactive waste. DOE NNSA assisted the RF Navy in performing the same MPC&A ship-based and land-based (at specific shore locations where the ships may be docked) system upgrades, including response force capabilities for PM-12 and PM-74 that were completed for Northern Fleet PM-63. Integrated MPC&A system upgrades incorporate detection, communications, delay, response, material control, and item accountancy. Commissioning ceremonies were held in September 2000 for each PM ship.

Pacific Fleet Spent Fuel Storage Site 32 – This is the designated Pacific Fleet consolidated land-based storage site for RF naval spent fuel. It is co-located with the Pacific Fleet Fresh

Fuel Storage Facility Site 34 near Vladivostok. Integrated MPC&A system upgrades incorporate detection, communications, delay, response, material control, and item accountancy. The commissioning ceremony for this site was held in September 2000.

Pacific Fleet Fresh Fuel Storage Site 34 - This is the agreed upon Pacific Fleet consolidated land-based storage site for naval fresh fuel that is located near Vladivostok. A structurally unsound building was replaced with a new storage facility that incorporates the same MPC&A features of the Northern Fleet Fresh Fuel Storage Site 49. This new facility has a hardened entrance portal to control access and the integrated MPC&A system incorporates detection, communications, delay, response, material control, and item accountancy. Construction began in Spring 1999. A commissioning ceremony was held in September 2000.

Shipyard 49K – The RF Navy requested DOE NNSA to consider funding improvements to a RF Navy shipyard in Kamchatka to provide that shipyard with the ability to defuel and dismantle nuclear submarines. A Russian feasibility study/conceptual design report was completed in April 2000 which proposed a specific design scope for aspects of upgrading the facility to accomplish the defueling and dismantlement of Russian nuclear submarines in a manner that reduced the proliferation risk. This report was reviewed by U.S. DOE NNSA experts. Recently during an U.S. interagency review, it was determined, that not enough information was available to make an unequivocal determination that the submarines pose a nonproliferation and national security threat to the U.S. and not merely an environmental problem. Therefore, no further action has been taken on this request.

CONCLUSION

The work achieved in the MPC&A Program with the RF Navy is due primarily to cooperating in a consistent, step-by-step manner with the same project teams throughout the upgrades phase. The MPC&A Program is now entering a new phase of cooperation with several facilities having completed security system upgrades and many more are expected to be completed in the near future. In order to ensure the sustainability of these systems, we have begun to implement a strategy beginning with the Kola Technical Center Project that is designed to ensure long-term, efficient operation of the upgraded sites after the DOE NNSA MPC&A Program support ends.